SPRING 2017 SEMI-ANNUAL WATER QUALITY MONITORING REPORT FOR THE HALIFAX MUNICIPAL LANDFILL

July 31, 2017

VTDEC Project NS95-0165

Prepared for:

Town of Halifax
P.O. Box 45
Halifax, Vermont 05358

Prepared by:

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KAS Project #610110045

Introduction

KAS, Inc (KAS) conducted a semi-annual water quality monitoring event on May 30, 2017 at the Halifax Landfill (Site Location Map and Site Map in Appendix A). A groundwater sample was collected from monitoring well MW-3 and analyzed for perfluorinated compounds (PFCs) via EPA Method 537 (short list). All sampling and analysis was conducted in accordance with the current landfill certification.

The sample was field analyzed for temperature, pH, and specific conductance using a properly calibrated YSI® Pro Multi-Meter. The depth to water was gauged using a Geotech™ water level indicator.

Results

Field measurements

Depth to water in MW-3 was measured at 5.07 feet below top of casing (btoc). The water temperature was 9.9 degrees Celsius and a pH value of 7.04 standard units was recorded at the time of sampling. The depth to water, temperature and pH measurements recorded are within range of historical measurements. A specific conductance reading of 470.7 µS/cm was noted at the time of sampling and is within range of historical fluctuations. Field measurement data is tabulated in Appendix B.

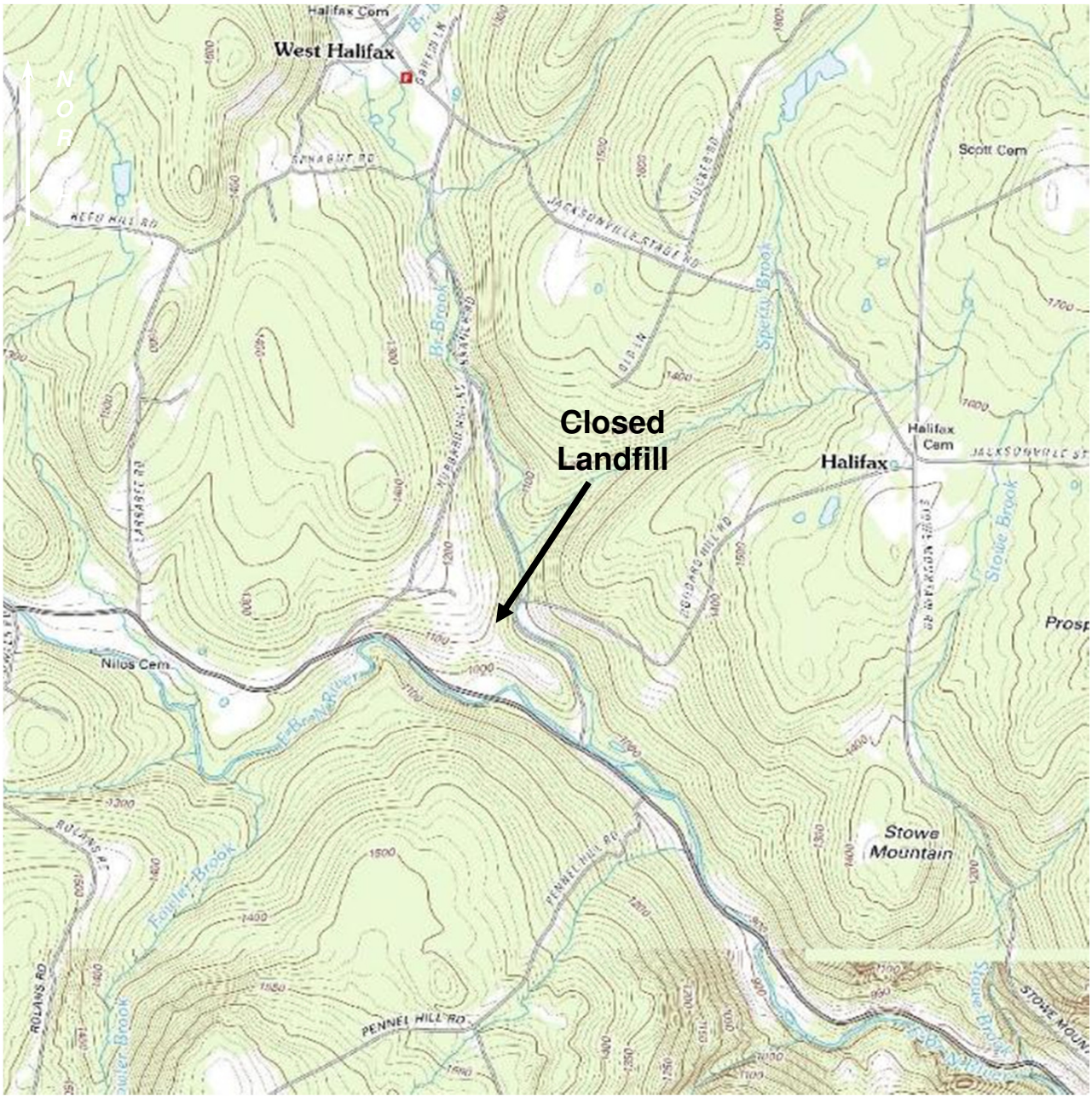
Laboratory results

Analytical testing indicated the presence of several PFCs in the groundwater sample collected from MW-3. A combined concentration of perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS) in MW-3 was reported at 110.3 parts per trillion (ng/l) which exceeds the Vermont groundwater enforcement standard (VGES) of 20 ng/l. No PFCs were detected above laboratory method detection limits in the trip blank sample. Current and historical analytical data is tabulated in Appendix B and a copy of the laboratory report is provided in Appendix C.

While PFC concentrations in MW-3 are presently the highest reported to date, the data set is still inadequate (only two sampling rounds) to evaluate trends. The next groundwater monitoring event is scheduled to occur in October 2017.

APPENDIX A

Site Location Map and Site Map



KAS Job Number: 610110045

Source: http://anrmaps.vermont.gov/websites/anra5/

TOWN OF HALIFAX CLOSED LANDFILL

2044 Branch Road, Halifax, VT

Site Location Map

Date: 05/25/16	Drawing No. 0	Scale: NTS	By: CS

MONITORING WELL

SURFACE WATER SAMPLE

* montoring well and surface water locations are approximate

VTDEC Project: NS95-0165
KAS Job Number: 610110045
Source: Google Earth

HALIFAX CLOSED LANDFILL

2044 Branch Road, Halifax, VT

SITE MAP

Date: 07/31/17	Drawing No. 2	Scale: NTS	By: RT

APPENDIX B

Historical Sampling Data

GROUNDWATER QUALITY SUMMARY

HALIFAX LANDFILL
HALIFAX, VT

MW-3

Parameter (PPM unless noted)	VGES	PAL	SAMPLING DATE: Aug-93	Dec-95	May-96	Nov-96	May-97	Oct-97	May-98	Oct-98	May-99	Oct-99	May-00	Dec-00	Oct-01	Jan-02	Jun-02	Dec-02	Jun-03
pH**	change of 1 ph unit		6.4	6.27	6.1	6.1	6.4	6.3	6.2	5.8	6.2	6	6.6	6.5	6.5	nt	6.5	6.6	6.7
Conductivity (µS/cm)**	change of 100 µs/cm		328	440	600	610	530	380	480	280	340	390	520	500	320	nt	nt	360	430
COD**	change of 25 ppm		6.9	ND<50	22	16	16	18	10	20	20	10	20	10	10	nt	30	20	20
Chloride*	250	125	14	27	29	26	20	1	17	8	14	ND<1	18	17	8	nt	15	10	12
Sodium* & ** (change of 10 ppm)	250	125	nt	23	28	27	23	15	18	11	14	nt	21	16	13	nt	39	11	16
Ca Hardness**	change of 100	NA	nt	nt	230	nt	230	160	220	120	150	190	230	190	130	nt	nt	130	220
Dissolved Chromium	0.1	0.05	nt	ND<0.05	ND<0.002	ND<0.002	0.003	ND<0.002	ND<0.002	0.004	ND<0.002	ND<0.002	ND<0.002	0.005	0.004	nt	ND<0.001	ND<0.001	ND<0.001
Dissolved Copper	1.3	0.65	nt	ND<0.05	ND<0.01	ND<0.01	0.03	ND<0.01	ND<0.01	0.02	ND<0.01	ND<0.01	0.01	0.02	0.002	nt	0.003	0.001	0.002
Dissolved Iron*	0.3	0.15	0.06	ND<0.05	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	0.18	nt	nt
Dissolved Manganese*	0.05	0.025	ND<0.02	ND<0.05	ND<0.005	0.046	0.22	0.075	0.38	0.45	0.21	0.067	0.12	0.28	0.015	nt	0.005	ND<0.005	ND<0.005
Dissolved Nickel	0.1	0.05	nt	ND<0.05	ND<0.01	ND<0.01	ND<0.01	ND<0.01	ND<0.01	ND<0.01	ND<0.01	nt	ND<0.01	ND<0.01	0.002	nt	0.003	ND<0.001	0.001
Dissolved Zinc*	5	2.5	nt	ND<0.05	0.07	0.057	0.095	0.015	0.058	0.042	0.013	0.015	0.014	0.024	0.24	nt	0.23	0.084	0.2
Dissolved Arsenic	0.05	0.005	nt	ND<0.010	ND<0.002	ND<0.01	ND<0.01	ND<0.01	ND<0.01	ND<0.01	ND<0.01	ND<0.01	ND<0.01	ND<0.01	0.003	nt	ND<0.001	ND<0.001	ND<0.001
Dissolved Cadmium	0.005	0.0025	nt	ND<0.005	ND<0.0005	ND<0.001	ND<0.001	ND<0.001	nt	ND<0.001	ND<0.001	ND<0.001	0.002	ND<0.001	ND<0.001	nt	ND<0.001	ND<0.001	ND<0.001
Dissolved Lead	0.015	0.005	nt	ND<0.005	ND<0.001	ND<0.01	ND<0.01	ND<0.01	ND<0.01	0.01	ND<0.01	ND<0.01	ND<0.01	ND<0.01	ND<0.001	nt	ND<0.001	ND<0.001	ND<0.001
Calcium	NA	NA	nt	nt	nt	nt	nt	nt	2.3	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt
Methylene Chloride	0.005	0.0005	ND<10	ND<2	ND<2	ND<2	ND<2	nt	ND<2	nt	nt	ND<5	nt	nt	nt	ND<5	nt	1600[E]	560

Parameter (PPM unless noted)	VGES	PAL	SAMPLING DATE: 11/3/03	6/17/04	10/28/04	12/1/05	5/6/06	10/6/06	5/7/07	10/7/07	5/8/08	10/24/08	5/15/09	10/22/09	5/10/10	10/13/10	5/25/11	10/26/11	5/8/12
pH**	change of 1 ph unit		6.1	6.1	ns	ns	nt	6.63	5.67	6.41	6.41	6.78	6.59	NR	6.15	6.49	6.03	6.63	6.70
Conductivity (µS/cm) **	change of 100 µs/cm		450	420	ns	ns	nt	391	329	128	128	413	92	108	83.4	223.3	83.8	387.6	599
Temperature (degrees C)	change of 5.6 deg C		nt	nt	ns	ns	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	10.9	11.7
Depth to Water (feet btoc)	NA	NA	nt	nt	ns	ns	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	4.60	4.41
COD**	change of 25 ppm		10	20	ns	ns	121	60	ND<10	50	10	<10	28	290	29	27	11	18	nt
Chloride*	250	125	12	12	ns	ns	1460	1	10	6	9	7	2.8	6.2	ND<2.5	5.7	4.3	12	6.2
Sodium* & ** (change of 10 ppm)	250	125	17	28	ns	ns	17.6	ND<5	15	ND<5	16	13	2.3	2.7	1.9	10	2	12	13
Ca Hardness**	change of 100	NA	170	180	ns	ns	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt
Dissolved Chromium	0.1	0.05	ND<0.001	ND<0.001	ns	ns	ND<0.002	ND<0.001	0.004	ND<0.001	0.002	ND<0.001	ND<0.02	ND<0.02	ND<0.005	ND<0.005	ND<0.005	ND<0.005	nt
Dissolved Copper	1.3	0.65	0.001	0.002	ns	ns	ND<0.05	0.002	0.01	0.002	0.002	ND<0.001	ND<0.02	ND<0.02	ND<0.02	ND<0.02	ND<0.02	ND<0.020	nt
Dissolved Iron*	0.3	0.15	ND<0.05	ND<0.05	ns	ns	0.35	0.1	3.6	0.08	ND<0.05	ND<0.05	0.17	0.88	0.1	0.11	0.2	ND<0.020	ND<0.020
Dissolved Manganese*	0.05	0.025	ND<0.005	ND<0.005	ns	ns	0.05	0.006	0.079	0.007	ND<0.005	ND<0.005	ND<0.02	0.15	ND<0.02	ND<0.02	ND<0.02	ND<0.020	ND<0.020
Dissolved Nickel	0.1	0.05	ND<0.001	0.002	ns	ns	ND<0.05	0.003	0.007	0.003	0.005	0.004	ND<0.02	ND<0.02	ND<0.005	ND<0.005	ND<0.005	ND<0.005	nt
Dissolved Zinc*	5	2.5	0.078	0.13	ns	ns	ND<0.01	0.047	0.045	0.033	0.013	0.007	ND<0.02	ND<0.02	ND<0.005	ND<0.005	0.007	ND<0.020	nt
Dissolved Arsenic	0.05	0.005	ND<0.001	ND<0.001	ns	ns	ND<0.002	ND<0.002	ND<0.001	ND<0.001	ND<0.001	ND<0.001	ND<0.002	ND<0.002	ND<0.001	ND<0.001	ND<0.001	ND<0.020	nt
Dissolved Cadmium	0.005	0.0025	ND<0.001	ND<0.001	ns	ns	ND<0.0005	ND<0.0005	ND<0.001	ND<0.001	ND<0.001	ND<0.001	ND<0.002	ND<0.002	ND<0.002	ND<0.002	ND<0.002	ND<0.002	nt
Dissolved Lead	0.015	0.005	ND<0.001	ND<0.001	ns	ns	ND<0.002	ND<0.001	0.003	ND<0.001	ND<0.001	ND<0.001	ND<0.001	ND<0.001	ND<0.001	ND<0.001	ND<0.001	ND<0.001	nt
Calcium	NA	AN	nt	nt	ns	ns	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt
Methylene Chloride	0.005	0.0005	ND<5	ND<5	ns	ns	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt

continued on next page

Notes:
Only detected or previously detected volatile organic compounds are listed.
btoc = below top of casing
ND<xx = Not Detected< Detection Limit
VGES = Vermont Groundwater Enforcement Standard (December 2016)
PAL = Preventative Action Level (December 2016)
NA = No VGES/PAL available
Results reported above detection limits are indicated in bold.

ns = not sampled
nt = not tested during sampling round
* = secondary groundwater quality standards (mg/L or ppm)
** = maximum acceptable change (units as noted)
*** = All perfluorinated compound values reported in ng/L. Analysis via EPA Method 537 (short list)
VGES and PALs pertain to total metals and are provided for reference only
E - The reported value exceeds largest calibration standard. Extrapolation of the calibration curve was employed to obtain the reported value.

= exceeds PAL
= exceeds VGES
= exceeds max acceptable change

GROUNDWATER QUALITY SUMMARY

HALIFAX LANDFILL
HALIFAX, VT

MW-3 (continued)

Parameter (PPM unless noted)	VGES	PAL	SAMPLING DATE: 10/9/12	5/30/13	10/16/13	5/15/14	10/21/14	5/28/15	10/29/15	May-16	10/19/16	5/30/2017
pH**	change of 1 ph unit		**6.06**	**6.71**	**6.09**	**6.05**	**5.73**	**6.56**	**6.71**	ns	nt	**7.04**
Conductivity (µS/cm)**	change of 100 µs/cm		**293**	**215.6**	**625**	**358.1**	**187**	**376**	**340.6**	ns	nt	**470.7**
Temperature (degrees C)	change of 5.6 deg C		**11.5**	**15.7**	**11.3**	**12.5**	**13.2**	**10.7**	**13.0**	ns	nt	**9.9**
Depth to Water (feet btoc)	NA	NA	**5.63**	**4.38**	**5.49**	**5.23**	**5.34**	**5.55**	**4.51**	ns	**6.87**	**5.07**
COD**	change of 25 ppm		nt	**22**	nt	nt	nt	nt	nt	ns	nt	nt
Chloride*	250	125	**19**	**12**	**6.5**	**5.7**	**6.7**	**4.5**	**52**	ns	nt	nt
Sodium* & ** (change of 10 ppm)	250	125	**12**	**13**	nt	nt	nt	nt	nt	ns	nt	nt
Dissolved Chromium	0.1	0.05	nt	ND<0.005	nt	nt	nt	nt	nt	ns	nt	nt
Dissolved Copper	1.3	0.65	nt	ND<0.020	nt	nt	nt	nt	nt	ns	nt	nt
Dissolved Iron*	0.3	0.15	ND<0.020	ND<0.020	**0.030**	**0.086**	**0.020**	ND<0.020	ND<0.020	ns	nt	nt
Dissolved Manganese*	0.05	0.025	ND<0.020	ND<0.020	ND<0.020	ND<0.020	ND<0.020	ND<0.020	ND<0.020	ns	nt	nt
Dissolved Nickel	0.1	0.05	nt	ND<0.005	nt	nt	nt	nt	nt	ns	nt	nt
Dissolved Zinc*	5	2.5	nt	ND<0.020	nt	nt	nt	nt	nt	ns	nt	nt
Dissolved Arsenic	0.05	0.005	nt	ND<0.001	nt	nt	nt	nt	nt	ns	nt	nt
Dissolved Cadmium	0.005	0.0025	nt	ND<0.002	nt	nt	nt	nt	nt	ns	nt	nt
Dissolved Lead	0.015	0.0015	nt	ND<0.001	nt	nt	nt	nt	nt	ns	nt	nt
Perfluorobutanesulfonic acid (PFBS)***	NA	NA	nt	nt	nt	nt	nt	nt	nt	ns	ND<11	ND<6.6
Perfluorohexanesulfonic acid (PFHxS)***	NA	NA	nt	nt	nt	nt	nt	nt	nt	ns	ND<3.8	**11.7**
Perfluoroheptanioic acid (PFHpA)***	NA	NA	nt	nt	nt	nt	nt	nt	nt	ns	**2.06**	**22**
Perfluorooctanoic acid (PFOA)***	20	10	nt	nt	nt	nt	nt	nt	nt	ns	**11.5**	**78.2**
Perfluorooctanesulfonic acid (PFOS)***			nt	nt	nt	nt	nt	nt	nt	ns	**16.7**	**32.1**
Perfluorononanoic acid (PFNA)***	NA	NA	nt	nt	nt	nt	nt	nt	nt	ns	ND<2.3	ND<1.5

Notes:
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*** = All perfluorinated compound values reported in ng/L. Analysis via EPA Method 537 (short list)
VGES and PALs pertain to total metals and are provided for reference only
E - The reported value exceeds largest calibration standard. Extrapolation of the calibration curve was employed to obtain the reported value.

= exceeds PAL
= exceeds VGES
= exceeds max acceptable change

APPENDIX C

Laboratory Report

NORTHERN LAKE SERVICE, INC.
Analytical Laboratory and Environmental Services
400 North Lake Avenue - Crandon, WI 54520
Ph: (715)-478-2777 Fax: (715)-478-3060

ANALYTICAL REPORT

WDNR Laboratory ID No. 721026460
WDATCP Laboratory Certification No. 105-330
EPA Laboratory ID No. WI00034

NLS Project: 280472
NLS Customer: 108400
Phone: 802 383 0486
PO # 610110045

Client: **KAS**
Attn: Rebecca Treat
589 Avenue D, Suite 10
PO Box 787
Williston, VT 05495

Project: **Halifax Landfill**

MW-3 NLS ID: 995345
COC: 189459:1 Matrix: GW
Collected: 05/30/17 10:15 Received: 06/06/17

Parameter	Result	Units	Dilution	MRL		Analyzed	Method	Lab
Perfluorinated Chemicals by EPA Method 537 Rev 1.1	see attached					06/09/17	EPA 537 Rev 1.1	721026460
Solid Phase Extraction by EPA Method 537	yes					06/07/17	EPA 537	721026460

MW-3, Field Blank NLS ID: 995346
COC: 189459:1 Matrix: FB
Collected: 05/30/17 10:00 Received: 06/06/17

Parameter	Result	Units	Dilution	MRL		Analyzed	Method	Lab
Perfluorinated Chemicals by EPA Method 537 Rev 1.1	see attached					06/15/17	EPA 537 Rev 1.1	721026460
Solid Phase Extraction by EPA Method 537	yes					06/13/17	EPA 537	721026460

Values in brackets represent results greater than or equal to the LOD but less than the LOQ and are within a region of "Less-Certain Quantitation". Results greater than or equal to the LOQ are considered to be in the region of "Certain Quantitation". LOD and/or LOQ tagged with an asterisk(*) are considered Reporting Limits. All LOD/LOQs adjusted to reflect dilution and/or solids content.
ND = Not Detected (< LOD) LOD = Limit of Detection LOQ = Limit of Quantitation NA = Not Applicable
DWB = Dry Weight Basis %DWB = (mg/kg DWB) / 10000 1000 ug/L = 1 mg/L
MCL = Maximum Contaminant Levels for Drinking Water Samples. Shaded results indicate >MCL.

Reviewed by:

Authorized by:
R. T. Krueger
President

ANALYTICAL RESULTS: Perfluorinated Chemicals by EPA 537 Rev 1.1 Safe Drinking Water Analysis
Customer: KAS NLS Project: 280472 PO # 610110045
Project Description: Halifax Landfill
Project Title: Template: 537PPT Printed: 06/26/2017 14:39

Sample: 995345 MW-3 Collected: 05/30/17 Analyzed: 06/09/17 - Analytes: 6

ANALYTE NAME	RESULT	UNITS WWB	DIL	LOD	LOQ	Note
perfluorobutanesulfonic acid (PFBS)	ND	ppt	1	6.6	21	
perfluoroheptanoic acid (PFHpA)	22	ppt	1	0.80	2.6	
perfluorohexanesulfonic acid (PFHxS)	11.7	ppt	1	2.8	8.8	
perfluorooctanoic acid (PFOA)	78.2	ppt	1	1.2	3.9	
perfluorononanoic acid (PFNA)	ND	ppt	1	1.5	4.9	
perfluorooctanesulfonic acid (PFOS)	32.1	ppt	1	1.7	5.3	
C13-PFHxA (SURR)	93.469%					S
C13-PFDA (SURR)	81.284%					S

NOTES APPLICABLE TO THIS ANALYSIS:
S = This compound is a surrogate used to evaluate the quality control of a method.

Sample: 995346 MW-3, Field Blank Collected: 05/30/17 Analyzed: 06/15/17 - Analytes: 6

ANALYTE NAME	RESULT	UNITS WWB	DIL	LOD	LOQ	Note
perfluorobutanesulfonic acid (PFBS)	ND	ppt	1	6.6	21	
perfluoroheptanoic acid (PFHpA)	ND	ppt	1	0.80	2.6	
perfluorohexanesulfonic acid (PFHxS)	ND	ppt	1	2.8	8.8	
perfluorooctanoic acid (PFOA)	ND	ppt	1	1.2	3.9	
perfluorononanoic acid (PFNA)	ND	ppt	1	1.5	4.9	
perfluorooctanesulfonic acid (PFOS)	ND	ppt	1	1.7	5.3	
C13-PFHxA (SURR)	81.323%					S
C13-PFDA (SURR)	101.846%					S

NOTES APPLICABLE TO THIS ANALYSIS:
S = This compound is a surrogate used to evaluate the quality control of a method.

The PFOA branch isotope peak is included in the PFOA calculation per EPA directive.

SAMPLE COLLECTION AND CHAIN OF CUSTODY RECORD

NORTHERN LAKE SERVICE, INC.

Analytical Laboratory and Environmental Services

400 North Lake Avenue • Crandon, WI 54520-1298

Tel: (715) 478-2777 • Fax: (715) 478-3060

Wisconsin DNR cert ID
721026460 (Cran) / 268533760 (Wauk)
Wisconsin DATCP ID
105-000330 (Cran) / 105-000479 (Wauk)

NO. 189459

CLIENT	KAS, INC.
ADDRESS	PO BOX 787
CITY	WILLISTON
STATE	VT
ZIP	05495
PROJECT DESCRIPTION / NO.	HALIFAX LANDFILL
QUOTATION NO.	
DNR FID #	
DNR LICENSE #	
CONTACT	REBECCA TREAT
PHONE	802-383-0486
PURCHASE ORDER NO.	610110045
FAX	802-383-0490

MATRIX:
SW = surface water
WW = waste water
GW = groundwater
DW = drinking water
TIS = tissue
AIR = air
SOIL = soil
SED = sediment
PROD = product
SL = sludge
OTHER

ANALYZE PER ORDER OF ANALYSIS

USE BOXES BELOW: Indicate Y or N if GW Sample is field filtered.
Indicate G or C if WW Sample is Grab or Composite.

ITEM NO.	NLS LAB. NO.	SAMPLE ID	COLLECTION DATE	COLLECTION TIME	MATRIX (See above)		PFCs via EPA Method 537										COLLECTION REMARKS (i.e. DNR Well ID #)
							G										
1.	995345	MW-3	05/30/17	1015	GW		X										ms/msd bottles collected
2.	995346	TRIP BLANK	↓	1000	BLANK H2O		↓										
3.																	
4.																	
5.																	
6.																	
7.																	
8.																	
9.																	
10.																	

ONE SAMPLE PER LINE

Q Kit

COLLECTED BY (signature)	CUSTODY SEAL NO. (IF ANY)	DATE/TIME 06/01/17 0915
RELINQUISHED BY (signature)	RECEIVED BY (signature)	DATE/TIME 06/05/17 1050
DISPATCHED BY (signature)	METHOD OF TRANSPORT UPS - OVERNIGHT AIR	DATE/TIME 06/05/17 1100
RECEIVED AT NLS BY (signature)	DATE/TIME 6/06/17 10:30	CONDITION / TEMP 4.2°
COOLER #	REMARKS & OTHER INFORMATION	
	WDNR FACILITY NUMBER	E-MAIL ADDRESS

REPORT TO: KAS, INC.

INVOICE TO: KAS, INC.

PRESERVATIVE:
NP = no preservative
S = sulfuric acid
N = nitric acid
Z = zinc acetate
M = methanol
OH = sodium hydroxide
HA = hydrochloric & ascorbic acid
H = hydrochloric acid

IMPORTANT:

1. TO MEET REGULATORY REQUIREMENTS, THIS FORM **MUST** BE COMPLETED IN DETAIL AND INCLUDED IN THE COOLER CONTAINING THE SAMPLES DESCRIBED.
2. PLEASE USE ONE LINE PER SAMPLE, **NOT** PER BOTTLE.
3. RETURN THIS FORM WITH SAMPLES - CLIENT MAY KEEP YELLOW COPY.
4. PARTIES COLLECTING SAMPLE, LISTED AS **REPORT TO** AND LISTED AS **INVOICE TO** AGREE TO STANDARD TERMS & CONDITIONS ON REVERSE.

Rev. 7/20/15